

Summary of the workshop on technology upgradation in small-scale industries

8 November 1996

Sponsored by



**SWISS AGENCY FOR DEVELOPMENT
AND COOPERATION SDC**

Organized by



Contents

Executive report	1
Annexure 1 Schedule	7
Annexure 2 List of participants	11
Annexure 3 Presentation on foundry and glass industry and the importance of SSI in India's energy economy	15
Annexure 4 Presentation on technology upgradation in brick industry	19
Annexure 5 Presentation on energy technology upgradation in silk reeling sector	23
Annexure 6 Presentation on policy and institutional interventions to promote technological upgradation in the small-scale sector	29

Executive report

Introduction

The Tata Energy Research Institute (TERI), in partnership with the Swiss Agency for Development and Cooperation (SDC), organized a one day workshop on technology upgradation in small-scale industries (SSIs). The workshop primarily focused on the TERI-SDC partnership which involved several projects on bringing about improvements in SSIs by enhancing energy efficiency and reducing pollution. It aimed at disseminating the results obtained so far and the approach of the TERI-SDC intervention in the small-scale sector to a wider audience. The schedule of the workshop is given in *annexure 1*.

Among the participants at the workshop were His Excellency Mr Guy Ducrey, Ambassador of Switzerland to India; Dr G Thimmaiah, Member, Planning Commission; Dr E Ledergerber, Econcept, Switzerland (Member of Parliament, Switzerland); and Dr R K Pachauri, Director, TERI, New Delhi. A complete list of participants is given in *annexure 2*.

In his inaugural address, H E. Mr Guy Ducrey, highlighted that TERI has been selected by SDC to play a key role in the field of energy and environment. The TERI-SDC partnership has been extremely productive and would have a better impact in developing a new global role. The work done by TERI in silk reeling, foundry, and glass sectors has been quite significant.

Dr Thimmaiah highlighted that technology upgradation is a top priority for small-scale sector since it would lead to reduced cost of production and improved quality. Studies conducted by different agencies show that 20-30% of energy can be saved by practicing energy conservation and technology upgradation. Lack of capital for technology upgradation to achieve economy of scale has been a major constraint for small-scale units.

The technical session of the workshop included presentations on each of the sectors of intervention namely, foundry, glass, brick, and silk reeling industry followed by a panel discussion.

Presentation on foundry and glass industry and the importance of SSI sector in India's energy economy

The presentation started with an overview of the small-scale sector. The importance of the sector was emphasized in terms of its contribution to the Indian economy. The sector provides for maximum employment, next only to agriculture; it accounts for one-third of the total exports and contributes to almost half the industrial production in value addition terms. At the same time, the sector also poses many problems. The performance of the SSIs, especially in the energy and environment front has been rather poor. There is substantial scope to improve through technological upgradation. Some salient features of the small-scale sector which makes it eligible for outside intervention and support were also discussed.

There are over 6000 small-scale foundry units in India. The minimum energy saving potential is 25% in



this sector. Very few units comply with environmental standards stipulated by the Central Pollution Control Board (CPCB), which is also because of the fact that appropriate, low cost, off-the-shelf technology is not available to many. In the present phase of the study (which is the second phase of the foundry project), demonstration of an improved energy efficient furnace along with an appropriate pollution control system, is underway. One of the major concerns highlighted is the availability of cost-effective, proven flue gas cleaning system resulting in a lot of hardship for the industry in meeting with the emission standards within the time-frame notified by the Supreme Court.

In the Firozabad glass cluster, where TERI is active, the major change taking place is in the supply of natural gas to the cluster. Major producers of glass have decided to change over from coal to natural gas operations and have already entered into a contract with Gas Authority of India Limited (GAIL). The TERI-SDC intervention in Firozabad includes demonstration of gas-fired pot furnace and energy efficient muffle furnace. Here also no off-the-shelf technologies are available. In each of the above components, TERI is being assisted by foundry and glass industry experts of international repute to offer solutions that meet the requirements of the local industry. The outline of the presentation is given in *annexure 3*.

Presentation on technology upgradation in brick industry

The major problems of the brick industry are environmental concerns, rising fuel costs, shortage of skilled labour, competition from alternative building material, and no R & D programmes. In the first phase of the study, energy audits of representative Bull's Trench kilns (BTK) were carried out. During the second phase, a vertical shaft brick kiln (VSBK) was built and operated in Datia (Madhya Pradesh) by Development Alternatives (DA). The action plan in the project is to collaborate with industry for dissemination of the results, conduct training and awareness programmes, and institutionalize policy measures/incentives for the new technology. The outline of the presentation is given in *annexure 4*.



Presentation on energy technology upgradation in silk reeling industry

The silk reeling sector in India mainly uses low grade fuelwood/biomass. The thermal efficiency is very low and there is no waste heat recovery system. Moreover, the pollution levels are also alarmingly high. The option of shifting to commercial fuels is not viable. Retrofitting of the existing systems with energy efficient ovens which will use fuel gas from biomass gasifier is more promising. A prototype gasifier was developed at the Gual Pahari campus of TERI and tested at units in Hindupur and Ramnagaram. Field testing of the units has shown 50% energy saving, higher productivity, and improvement in the quality of the product.

The major constraints to the propagation of gasifier technology which were highlighted during the workshop include difficulty in commercialization of the technology, few manufacturers of gasifiers, long lead time of development of the prototype to commercial scale, training of operators, poor financial condition of the industry, and lack of systematic R & D. The outline of the presentation is given in *annexure 5*

Presentation on policy and institutional interventions to promote technological upgradation in small-scale sector

The policy and institutional interventions to promote technological upgradation in the small-scale sector were highlighted in the presentation. The imperatives are environmental regulations and associated judicial oversight, economic competitiveness, and the quality of product. The major constraints and issues facing the small-scale sector are the lack of appropriate technology, uncertain financial conditions, inability to adopt and manage technological changes, and little internal/external R & D. In this scenario, the relevance of technological intervention becomes all the more important. The strategy adopted under the small-scale sector projects is to develop and demonstrate appropriate technological packages, market seeding by reducing the technology cost, and technological backup and training facilities. The intervention package has been developed for cluster-level intervention. The basic aim is to institutionalize the relationship between units and technological upgradation using the industrial associations as the base. A financial package along with a provision for monitoring and evaluation of the implementation is necessary for large-scale dissemination. The outline of the presentation is given in *annexure 6*



Panel discussion

Panelists Mr R K Sinha, Member PESB, Chairperson; Mr R H Khwaja, Joint Secretary, MoEF; Mr H R Pfeiffer, SDC, Mr Pierre Jaboyedoff, SDC; Dr V V N Kishore, TERI, Dr Ajay Mathur, TERI; Mr Somnath Bhattacharjee, TERI

Mr R K Sinha started the discussions by highlighting the importance of the small-scale sector and the decreasing competitiveness of SSIs. The problem of selecting the appropriate systems/regulations for the environment by the MoEF was highlighted by Mr Khwaja. The choice between participative collaborative system and mandatory statutory compliance is often difficult. He felt that reorganization of the industry and social implications should also be included in the framework.

Representatives from Process and Product Development Centre (PPDC), Agra wanted to know whether a technology for gas-based cupola is available since the foundry units in Agra may be forced to change over to natural gas. Mr Jaboyedoff was of the view that gas-driven cupola involves very high investment and hence its practical feasibility for small-scale units is doubtful.

Mr Pfeiffer mentioned the importance of technology development through R & D, reorganization of the industries and implementation of emission standards. The panelists agreed that for suc-

Successful intervention in the small-scale sector the different issues should be linked and a concerted effort for improvement be made.

Conclusions

The small-scale sector will continue to be a major stakeholder in India's energy-economy. The small-scale sector will continue to contribute significantly to the country's industrial production due to the rapid growth of the economy and the privileges enjoyed by this sector. However, the sector continues to deteriorate steadily, in the face of increased competition. This has called for restructuring the sector. In the foundry, glass, brick-kiln and silk reeling industries, small-scale enterprises occupy appropriate economic niches, either, due to easy access to raw materials and markets, or due to their flexibility in meeting export market commitments.

Lack of access to 'packages' available to upgrade the sector technologically. The increasing cost of energy, stringent regulations for environmental pollutions and their implementation, drives the small-scale sector to adopt more energy-efficient and less polluting technologies. Interactions with progressive enterprises indicate that many of them are willing to invest in such upgradation but are deterred by the inaccessibility to these technological packages and skills. Lack of skilled manpower has also constrained technological innovation in these sectors. Small-scale units suffer adversity in the absence of appropriate technological packages, despite their specialized niches in the economy.

Interventions to upgrade the technology are most effective at the cluster level: Small-scale enterprises in the four sectors under consideration (foundry, glass, brick-kiln, and sericulture) largely occur in clusters. This clustering is because of several reasons; availability of raw materials, easy access to large markets, availability of a pool of semi-skilled labour, etc. All the units in a cluster are subject to similar economic and regulatory forces, and hence are equally suited to adopt upgraded technological packages. Consequently, the development, demonstration, and subsequent deployment of advanced technologies is most effective within a cluster.

New packages should reflect state-of-the-art technological knowledge adapted to local conditions: Local and global economic competitiveness, as well as stringent environmental emission standards, compel the small-scale sector to adopt appropriate packages that are based on state-of-the-art technology. Emissions control from cupolas, enhancement of energy-efficiency in silk-reeling and brick-making, and the switch to natural gas in the glass units require advanced engineering skills. At the same time, the local manufacture and operation of these advanced technologies imply that some of the know-how has to be transferred to local manufacturers and enterprises. This is a resource-intensive process in terms of time, money, and manpower.

Access to adequate funds is required for technology development and deployment. Qualified technical manpower and the development of advanced technology packages require substantial upfront investments. This level of investment cannot be raised by the small-scale units themselves, and requires technology development grants or seed-capital. Subsequently, easy access to credit makes deployment easier. Therefore, the involvement of financial institutions (e.g. Small Industries Development Bank of India) in a technology development project is useful since it ensures that new technological packages are credit-worthy.

Annexure 1
Schedule

Schedule

3 00–3 55 pm

Inaugural session

Welcome address

Dr R K Pachauri, Director, TERI

Inaugural address

Dr G Thimmaiah, Member, Planning Commission

Presidential address

H E Mr Guy Ducrey, Ambassador of Switzerland to India

Achievements and deficiencies in European Energy Policy

Dr E Ledergerber

Econcept, Switzerland (Member of Parliament, Switzerland)

Vote of thanks

Dr Ajay Mathur, Dean, Energy Technology, TERI

4 00–5 05 pm

Technical session

Small-scale sector in the Indian energy economy & technology
upgradation in the foundry and glass industries

Mr Somnath Bhattacharjee, Fellow, TERI

Technology upgradation in the brick industry

Mr Sameer Maithel, Research Associate, TERI

Energy technology upgradation in the silk reeling industry

Dr V V N Kishore, Senior Fellow, TERI

Coffee break

Policy and institutional interventions to promote technological
upgradation in small-scale sector

Dr Ajay Mathur, Dean, Energy Technology, TERI

5 05–5 55 pm

Panel discussion

5 55–6 10 pm

Concluding address

Dr E A S Sarma, Principal Adviser, Planning Commission

6 10–6 15 pm

Vote of thanks

Mr Somnath Bhattacharjee

h

Annexure 2

List of participants

p

Participants

Central Pollution Control Board (CPCB)

Mr R C Kataria, Environmental Engineer
Mr D S Kharat, Environmental Engineer
 CPCB, Parivesh Bhavan
 East Arjun Nagar, Shahdara
 Delhi - 110 032

Delhi Management Association (DMA)

Mr S Kumar
 Programme Manager, DMA
 Habitat Place, Core 5A, 2nd floor
 Lodhi Road, New Delhi - 110 003

Department of Industrial Policy and Promotion (DIPP)

Mr K Sanghi
 Development Officer
 DIPP, Udyog Bhavan
 New Delhi - 110 011

Department of Science and Technology (DST)

Dr Kamla Kumar
 Joint Advisor, DST
 Technology Bhavan, New Mehrauli Road
 New Delhi - 110 016

Department of Small Scale Industries and Agro Rural Industries

Mr G S Kashyap
 Industrial Advisor
 DCSSI, Nirman Bhawan
 7th floor 'A' Wing
 New Delhi - 110 011

Embassy of Switzerland

H E Mr Guy Ducrey
 Ambassador of Switzerland to India
 Chandragupta Marg, Chanakyaपुर
 New Delhi - 110 021

Federation of Indian Chambers of Commerce and Industry (FICCI)

Mr Pradyumna S Dubey
 FICCI, Federation House

1, Tansen Marg
 New Delhi - 110 001

Gas Authority of India Limited (GAIL)

Mr V N Dutt
Mr R G Rajan
 GAIL, 16, Bhikaji Cama Place
 New Delhi - 110 066

Indian Renewable Energy Development Agency (IREDA)

Dr M Ramachandran
 General Manager, IREDA
 Habitat Place, Core 4A, 1st floor
 Lodhi Road, New Delhi - 110 003

Ministry of Environment and Forests (MoEF)

Mr R H Khwaja
 Joint Secretary
 MoEF, Paryavaran Bhavan
 CGO Complex, Lodhi Road
 New Delhi - 110 003

National Productivity Council (NPC)

Mr A K Vohra
 Director, NPC, Lodhi Road
 New Delhi - 110 003

Office of Development Commissioner—Small Scale Industries

Mr R K Arora
 Industrial Advisor (Elect)
Mr Lakshman Mishra
 Ministry of Industry
 Udyog Bhawan
 New Delhi - 110 011

Petroleum Conservation Research Association (PCRA)

Mr K K Dhingra
 Executive Director, PCRA
 1014, New Delhi House
 27, Barakhamba Road
 New Delhi - 110 001

PHD Chambers of Commerce and Industry (PHDCCI)

Ms Geeta Poduval

Mr R K Arora

PHD Chambers of Commerce & Industry

PHD House

Opp Asian Games Village

New Delhi - 110 016

Planning Commission

Dr G Thimmaiah

Member

Dr E A S Sharma

Principal Advisor

Public Enterprises Selection Board (PESB)

Mr R K Sinha

Member, PESB

PE Bhawan

14, CGO Complex

Lodhi Road

New Delhi - 110 003

Small Industries Development Bank of India (SIDBI)

Mr Manoj Sharma

Manager, SIDBI

10/10 Madan Mohan Malviya Marg

Lucknow - 1

Swiss Agency for Development and Cooperation (SDC)

Dr Urs Heierli

Dr E Ledergerber

Mr Hans Ruedi Pfeiffer

Dr Veena Joshi

Mr Pierre Jahoyedoff

Mr G S Nair

Embassy of Switzerland

Chandragupta Marg, Chanakya Park

New Delhi - 110 021

TERI

Dr R K Pachauri

Director

Dr Ajay Mathur

Dean

Dr V V N Kishore

Senior Fellow

Mr S Bhattacharjee

Fellow

Mr Sanjay Mande

Fellow

Mr Prosanto Pal

Fellow

Mr Girish Sethi

Fellow

Mr Sunil Dhingra

Research Associate

Mr Sameer Maithe

Research Associate

Mr N Vasudevan

Research Associate

Mr P Ghosh

Research Associate

Mr P Raman

Research Associate

Mr Alok Goyal

Research Associate

Mr Amit Kumar

Research Associate

Mr Debashish Pramanik

Research Associate

Mr Ashok Kumar Yadav

Research Assistant

Mr Kulbhushan Kumar

Research Assistant

Habitat Place

Darbari Seth Block

Lodhi Road

New Delhi - 110 003

United Nations Development Programme (UNDP)

Mr Sunil Arora

Programme Assistant

Mrs V Peris

55, Lodhi Estate

New Delhi - 110 003

•

Annexure 3

Foundry and glass industry and the importance of SSI in India's energy economy

•

Small-scale sector

- Significant polluters
- Substantial scope for technology upgradation
- Scope for human and institutional development
- Potential to develop standard solutions
- Better chances of replicability

Foundry

- | | |
|----------------------------|--------------|
| • Total number | 6000 plus |
| • Fuel source | Coke |
| • Coke/feed ratio | 1.3 to 1.4 |
| • Furnace design | Conventional |
| • Energy saving | 25% (Min) |
| • Environmental compliance | Marginal |

Scope of work

- Demonstration of improved furnace design and appropriate pollution control system.
- Technical support from Castings Development Centre, UK (BCIRA¹ group)
- Main concern is how to comply with the emission standards

Firozabad glass cluster

Major small-scale glass centre

- | | |
|---------------------------------|-----------------------|
| • Furnace types | Tank, pot, and muffle |
| • Total coal use | 750 tpd |
| • Energy conservation potential | 30% (Min) |
| • Environmental compliance | Marginal |

Scope of work

- Demonstration of gas-fired pot furnace
- Demonstration of more efficient muffle furnace
- Technical support from British Glass, UK
- Main concern is changeover to natural gas operation.

¹ BCIRA - British Cast Iron Research Association

2

Annexure 4

Technology upgradation in brick industry

•

Introduction

- Fired clay brick is the most popular building material
- Annual brick production in India is 50 billion bricks
- Labour employed is 1.5 million

Features

- Small brick kilns cater to local requirements
- Unorganized (very few registered units) sector
- Labour intensive
- Manual operation, very little use of electric power
- Highly energy intensive
- No major technology upgradation during last 100 years
- High volume, low margin business
- Seasonal industry

Problems

- Environmental concerns
 - Air pollution
 - Top soil loss
 - Deforestation
- Increasing cost of fuel
- Shortage of brick-making clays
- Shortage of skilled labour
- Competition from alternative building materials
- No systematic R & D programme, lack of extension service for support

Action points for technology upgradation

- Development and demonstration of appropriate technology on regional basis in collaboration with industry
 - Technology for shaping bricks
 - Firing of bricks
 - Using inferior quality clay for brick making
- Creation of extension service for dissemination of information and training facilities
- Active participation of Small Industries Service Institute (SISI), NGOs, district industry centres (DICs), state nodal agencies, research institutes, brick industry associations
- Policy measures/incentives for popularization of new technology

Energy use in brick industry

Fuel	Annual consumption
Coal	8 million tonnes
Biomass (fuelwood, agricultural residue, dungcakes)	7 million tonnes

Source TERI estimates

Traditional technologies

Technology	Scale of production (bricks per day)	Location	Specific energy consumption (MJ/kg fired brick)
Clamp	Small (up to 15 000)	South and Central India	1.75–2.50
Bulls Trench Kiln (BTK) (i) Movable chimney	Large (15 000–40 000)	Uttar Pradesh, Bihar, West Bengal, Assam, Gujarat, Madhya Pradesh	1.25–2.00
(ii) Fixed chimney	Large (15 000–40 000)	Punjab, Haryana, West Uttar Pradesh	1.10–1.50

New technologies

Technology	Scale of production	Status	Specific energy consumption (MJ/kg fired brick)
High draught kiln	Large	Commercial	0.90–1.1
Vertical Shaft brick kiln (VSBK)	Medium	Pilot plant	0.75–1.0
BTK with stoker	Large	Pilot plant	0.90–1.1

Activities of TERI

- Energy audits of existing kilns
- Energy monitoring of VSBK pilot plants
- Design guidelines for VSBK and BTK

•

Annexure 5

Energy technology upgradation in silk reeling sector

•

An overview of the silk reeling sector

- Cottage industry employs about 170 000 persons
 - Registered units
 - 26 000 cottage + 35 000 *charkha*
 - Active units
 - 6000 cottage + 18 000 *charkha*
- Nearly stagnant production
- Seemingly low profitability
- Low productivity (high *renditta*)
- Low yarn quality
- Heavy dependence on government support and intervention
- Process environmentally unsound (smoke, carbon monoxide, steam, and smell)
- Massive upgradation/improvement of technology (indigenously developed) is needed to make the enterprise viable

Energy and environment issues

- Low grade traditional energy used for processing
 - About 100 000 tonnes/year loose biomass
 - About 120 000 tonnes/year fuelwood logs
- Causing significant deforestation
 - About 120 000 trees/year
- Low thermal efficiency (12–14%) leading to high specific fuel consumption levels
 - 2.4–3.2 kg/kg cocoon for loose biomass
 - 1.4–2.5 kg/kg cocoon for fuelwood
 - About 0.37 kg/kg cocoon for stifling
- Low waste heat recovery
- High levels of pollution in the premises
[carbon monoxide (CO), smoke, steam, and smell]

CO emissions	Min –Max (ppm)	Average (ppm)
Near re-reeling	10–320	124
Between cooking and reeling	1–83	22
In ambient	0–2	1

Energy options

- Shift to commercial fuels like coal, natural gas, fuel oils, etc are ruled out due to considerations of cost/non-availability
- Only feasible options
 - Economic oven
 - Retrofitting
 - Gasification
 - Solar energy

- Field savings of economic ovens is approximately 14%
- Limited experience with retrofitting is not encouraging
- Use of solar energy is uneconomical at present due to requirements of large collection area
- Gasification is promising

Why gasification?

- Allows conversion of a low grade fuel (solid biomass) to a high grade fuel (combustible gas)
- Allows better control of process parameters like temperature, heating rate (power, etc) with possible improvements in quality and productivity
- Approximately 50% fuel can be saved
- Clean flue gases can be used for drying of jute waste and pupae
- Environmentally sound [emissions comparable to liquefied petroleum gas (LPG) burning]
- Use extendable to

steam stifling	dyeing
hot air stifling	boilers
<i>charkha</i> ovens	(for advanced methods of cooking)
- Economically viable

Market potential

- Approximately 6000 units deployable for cottage basins alone
- Assuming a penetration rate of 10% per year, production of 600 gasifiers per annum is feasible (turnover of Rs 2.5 crore¹)
- 10 to 15 entrepreneurs can set up production unit
- A single design can cater to a large percentage of reelers, e.g., frequency distribution in Ramnagaram cluster
- A detailed market assessment study is warranted

Comparison with traditional oven

Specific fuel consumption		Renditta		Silk quality		Quantification of daily savings (Rs)		
Gasifier	Cottage basin	Gasifier	Cottage basin	Gasifier	Cottage basin	Fuelwood saving	Renditta improvement	Total
1.37	1.95	7.20	7.27	71.5 (II)	53.5 (III)	58	160	213
1.41	1.96	7.45	7.61	69.5 (II)	60.5 (II)	55	339	388
1.51	2.62	8.04	8.13	65.5 (II)	55.5 (III)	111	165	265
1.18	2.23	6.96	7.01	—	—	105	123	217
0.89	1.75	7.93	8.02	—	—	86	170	247
1.10	1.80	7.84	7.96	—	—	70	231	296
1.24*	2.05*	7.57*	7.67*	51.08*	44.92*	80.83*	198*	271*

* average

¹ one crore = 1/100 billion

Installation and operation of units in Ramnagaram

- Attempted entrepreneur development
(fabrication and part installation done by the entrepreneur under TERI supervision)
- Initial under performance
(cocoon processing rate higher than average, defective fabrication and installation, different sizes of cooking vessels, inferior quality wood)
- Rectification of problems nearly completed
- Extension of use to stifling
- Preliminary study of pollution completed
- Cluster level study initiated
 - for assessing spatial and time variation of cocoon processing rate
 - for identifying most suitable capacity of gasifier
 - for assessing market size
 - for gauging user response for introduction of a new energy saving device

Elements of research action leading to commercialization

- Technology
- Demonstration-cum-market seeding
- Entrepreneur development
- Market development

Key constraints

- Technology of gasification
- Technology not fully mature for commercial use
- Very few attempts to develop commercial packages based on gasifier system.
- Entrepreneur/manufacturer largely dependent on subsidies and other incentives provided by the government
- The process of evolution from laboratory stage to final commercial model, accompanied by field testing, material optimization, and user satisfaction is time consuming.
- Gas is produced in a decentralized manner and has to be used *in-situ* unlike fuels like LPG which are produced in a centralized and organized way. Hence, considerable user training and maintenance support have to be provided and user acceptance can come only after painstaking and sustained interaction

Nature of industry

- Silk industry is protected by government support and intervention
- Indian silk cannot compete in international market because of high price and low quality (Rs 1300 per kg for Indian silk compared with Rs 800 per kg for Chinese silk)
- Low profit margins—only 6-8% of the total income share of silk processing comes to the reeler
- The poor financial condition of this sector does not enable the reeler to invest in new machinery and technology needed for upgradation and improvement

- No systematic efforts by R & D institutes for technology upgradation
- Process is labour intensive and environmentally unsound (high smoke, CO, steam, and smell)
- Labour availability is low due to preference to other sectors such as construction, agriculture, etc

Technology

- Development of commercial prototype (industrial design inputs)
- Ideas for second generation systems
- Development and testing of systems for *charkha* units
- Development and testing of gasifiers for dyeing
- Innovative stifling and cooking ideas
 - hot air stifling
 - steam cooking
 - three pan cooking
 - any other

Demonstration cum market seeding

- Installation of systems to cover five per cent of units in Ramnagaram cluster on build, own, lease, transfer (BOLT) basis
- Develop and test mechanisms for supply of wood chips
- Develop mechanisms for after-sales service and annual maintenance contract
- Develop manpower for operation of systems
- Mobile demonstration units

Entrepreneur development

- Identify possible manufacturers in various locations
- Hold discussions for production method, cost optimization, etc
- Explore options for credit availability
- Licensing, brand names, certification
- Develop quality control mechanisms

Market development

- Cluster level studies for market assessment
- Interact with financial institutions for development of financing mechanisms
- Explore options for soft loans, tax benefits etc.
- Assess market size for uses other than silk reeling (e g dyeing)
- Market seeding efforts for other applications.

Annexure 6

**Policy and institutional interventions to promote
technological upgradation in the small-scale sector**

Imperatives

- Environmental regulations, and associated judicial oversight
- Economic competitiveness, particularly in energy-intensive sectors
- Product quality upgradation.
- Preservation and enhancement of export markets

Constraints and issues

- Lack of appropriate technological packages, issues of marketing and credit access, and of the possibility of closure
- Lack of capability to adopt (and manage) technological change, issues of limitations in information, technology access and acquisition, and human resources

Strategy

- Development and demonstration of appropriate technological packages, enabling a multidisciplinary team of sectoral experts to set up demonstration units
- Market seeding, development of local technology suppliers, encourage adoption by units, promote cost-reduction, and reliability-enhancement
- Technological backup and financing facilities, provision for availability of on-site expertise for technological trouble shooting, enabling access to capital for investment

Interventions

- Cluster-level sectoral intervention seems appropriate, rather than national sectoral interventions. Performance specifications for technological package should be suitably framed
- Institutionalizing the relationships between the units in a cluster and with the technological upgradation activity helps in creating the 'shared vision' for cluster-wide implementation
- Technical expertise must be sourced from cutting-edge technology suppliers. They must have a clear mandate to develop a cutting-edge technology package suitable for local conditions
- The financial package should support the development and demonstration of the technology package (support technological backup and financing facilities), monitor and evaluate implementation, and access to credit
- Monitoring and evaluation of the implementation must provide feedback to enable course corrections